Instruction Manual

Nexus Technologies
Defined Area Early Warning System
Remote Console
Model SAM

NEXUS

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1 Introducing the SAM

It is important that the user read and understand this section so that they are aware of what the system can and cannot do for them. In times of emergency the DAEW can provide them with critical information about an impending threat, but what actions they should take in such circumstances are their choice entirely. The user must have a prepared plan of action – whether to stay and defend or evacuate in a safe and timely manner.

The DAEW must also not be considered to be one hundred percent reliable. No system can ever be. The user must understand that the DAEW information, like any other source of information, can be obsolete, inaccurate or at worst, incorrect. The DAEW is simply another method of keeping the user informed and should only be used to supplement not replace existing Internet, free-to-air or subscription media, telephone, SMS, audible warning system or other form of alert messaging.

1.1 Brief Overview

The Defined Area Early Warning (DAEW) system is aimed at assisting people living in bushfire prone areas to better protect themselves and make informed and timely decisions about evacuating or staying with property in the event of fire.

The DAEW system has been designed to provide a means of delivering a geographically specific threat warning to individuals or groups within high risk areas. Delivery areas are defined as cells on an arbitrary grid which may be as small as one kilometre. The system also caters for delivering the same message to an area as big as a Total Fire Ban district or even the entire state. This enables total fire ban information or district-wide fire danger ratings to be efficiently broadcast. The DAEW has been designed primarily as a fire warning system, but there is no reason why the system cannot be used for other geographically-specific threats such as flood or tsunami.

Messages consisting of a cell number and threat message codes are electronically sent to existing free-to-air FM radio stations for transmission. The system uses the FM Radio Data Service (RDS) to deliver the threat message information. These transmissions do not interfere with normal audio content.

The specially designed radio receiver (codenamed SAM) is used to decode and display the messages. SAM is a prototype radio receiver with a 24 hour battery backup, a text display, visual threat display and an audio alert. SAM is also able to control external devices such as sprinkler systems or rotate automated Fire Danger Rating Signs and is able to be solar powered.

The latest threat message for the receiver's cell remains on display, meaning that the user need only check the radio when able or convenient instead of having to listen at specific times.

It is important to note that SAM is only a prototype. It has been produced to demonstrate the core concepts of the DAEW system. It may be obvious that large amounts of money have not been spent on making it as sleek and stylish as an iPhone, indeed R&D has been solely devoted to making a robust and simple product

that fulfils the needs that drove the design requirements in the first place. There is much more that could be done within the existing design scope with just software changes and it is this functionality that is under examination in this trial.

There are several menu items that have no meaning, do not function or make no difference in operation. These are 'stubs' of functions that are either redundant, still under development or have yet to be implemented. Please approach any aberrant operation of these items with a little bit of patience and understanding.

1.2 The Key Concepts

1.2.1 Updating your cell

The DAEW transmits threat information to *all* cells in the coverage area *all* the time. As the information is broadcast by a free-to-air FM station, there is no limit on the number of receivers and no possibility of extra traffic overloading the system in emergency. All that is required is that the SAM receiver has good signal strength from the transmitter site. The SAM listens to all the DAEW messages transmitted, but only displays the threat codes for the cell it is programmed for.

The amount of information that the RDS subsystem can transmit is not without bounds. There is not a lot of 'bandwidth' available, so the DAEW information is quite succinct to keep update times or latency as low as possible. Realistically, it can take a couple of minutes to update all cells covered by a particular FM radio station if all cells are at the same threat level. Such a case isn't a problem when the threat level is the normal, non-critical one, but becomes more important when the threat is not trivial.

Currently all cells are given equal priority, but in future, a system with dynamic priority allocation would update cells at higher threat levels more frequently than those at lower levels.

At installation time the SAM will be assigned a cell identification code and this is stored in permanent memory. The SAM must remain in the cell it has been programmed for or else the information it delivers may not be accurate. Moving the SAM or changing its cell identification could render the device useless or worse to give information that is not accurate for where the receiver is physically located.

The final consideration is that the DAEW can only deliver the information that is fed to it. If this information is inaccurate or stale then the DAEW cannot improve it.

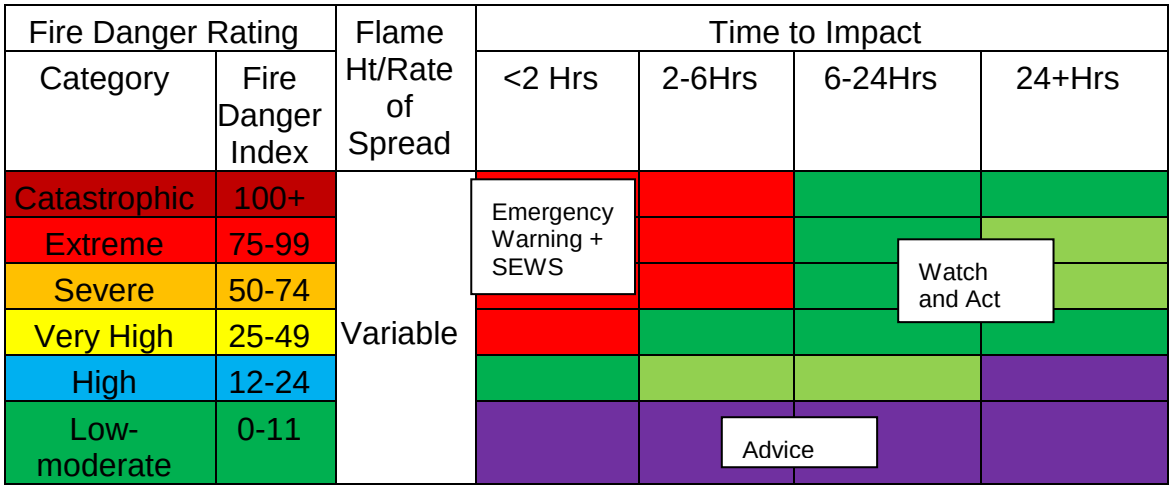
1.2.2 The information displayed

The SAM delivers the threat information for the cell it resides in the following ways

- In plain text on the LCD display
- On the colour-coded LED threat 'tree'
- As audible tones from the loudspeaker
- Via optional external threat display and or siren

The nomenclature and colours are harmonised with the current Fire Danger Rating (FDR) as reproduced in the following table.

There is also a separate Total Fire Ban Indicator down the bottom of the SAM front panel. Currently this will light whenever the threat is above the Low-Moderate level, but in future it is envisaged that this will be enabled by a unique signal delivered by the DAEW and may give advance warning of a TFB day to follow, at a time when the threat level may still be low.



1.2.3 Installation

1.2.3.1 Signal

The SAM receiver must be installed where it has a totally reliable and strong signal from the FM broadcaster carrying the DAEW service. The SAM comes with a 70cm whip antenna mounted directly to the case. This is suitable only for protected or inside use. If an external antenna is required or greater gain needed then an external directional FM or TV antenna may be needed.

1.2.3.2 Location

The SAM receiver is not weather proof. It must be located under cover of direct weather. It must also be located where there is access to permanent and reliable electricity supply. This can either be a mains power socket or DC feed from a solar installation.

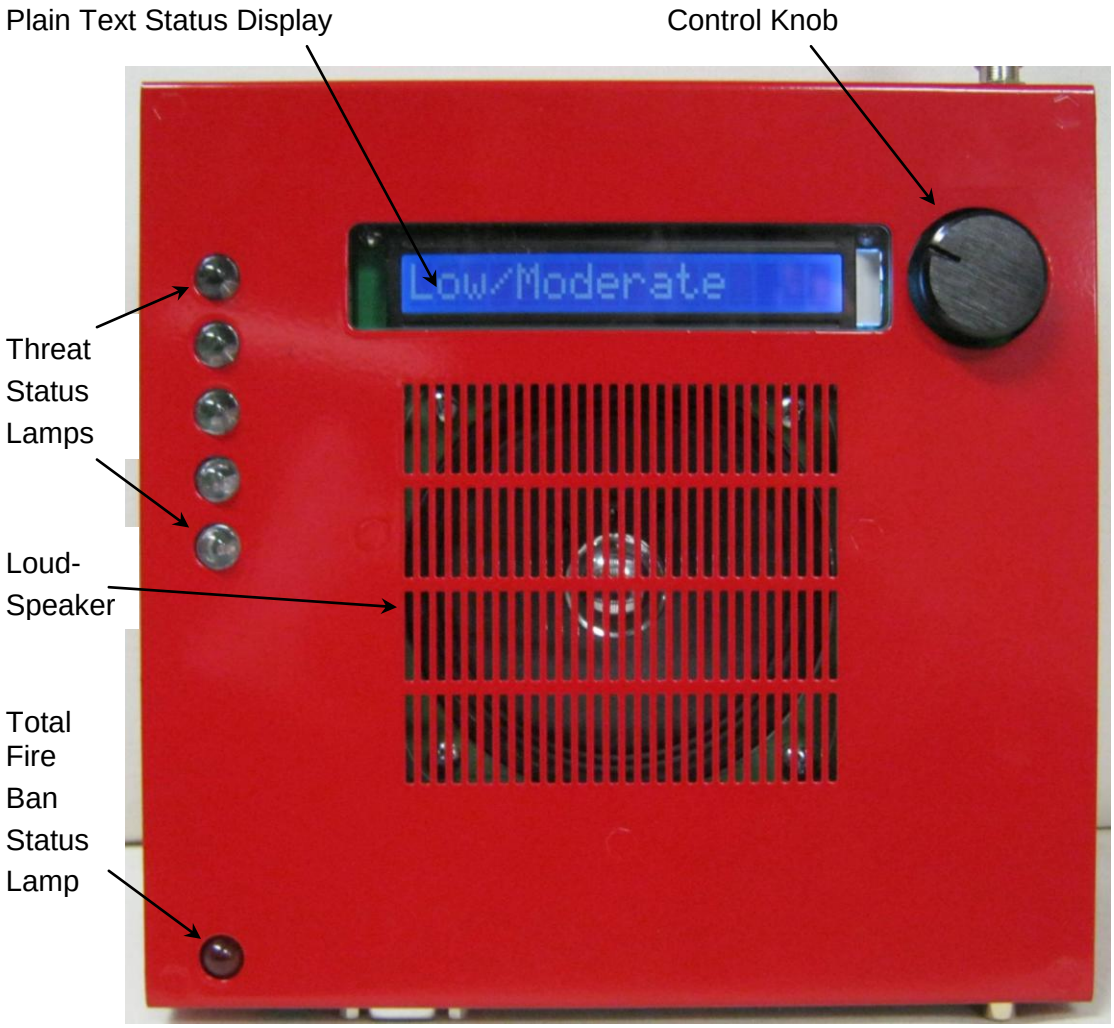
The SAM must be placed where it can attract attention. Out of sight, out of mind with this device is pointless. Place it where you are going to be able to see and hear it. If you need another one for the outhouse, back shed or second story, then either use the external siren and display facilities or consider purchasing supplementary unit(s).

1.2.4 Maintenance

The SAM has a 12V Sealed Lead-Acid battery, capable of providing at least 24 hours backup time under low-moderate threat conditions. This battery must be tested and renewed if necessary at least twice a year. There is some limited scope for the system to launch a battery self-test to the SAM, but at this time this functionality has not been implemented.

1.2.5 SAM Front Panel

Once installed, SAM needs no further attention other than when there is a change in the fire threat level to the cell that it is installed in. It is however, of the utmost importance to know what exactly is the information that SAM provides, and how it is shown.



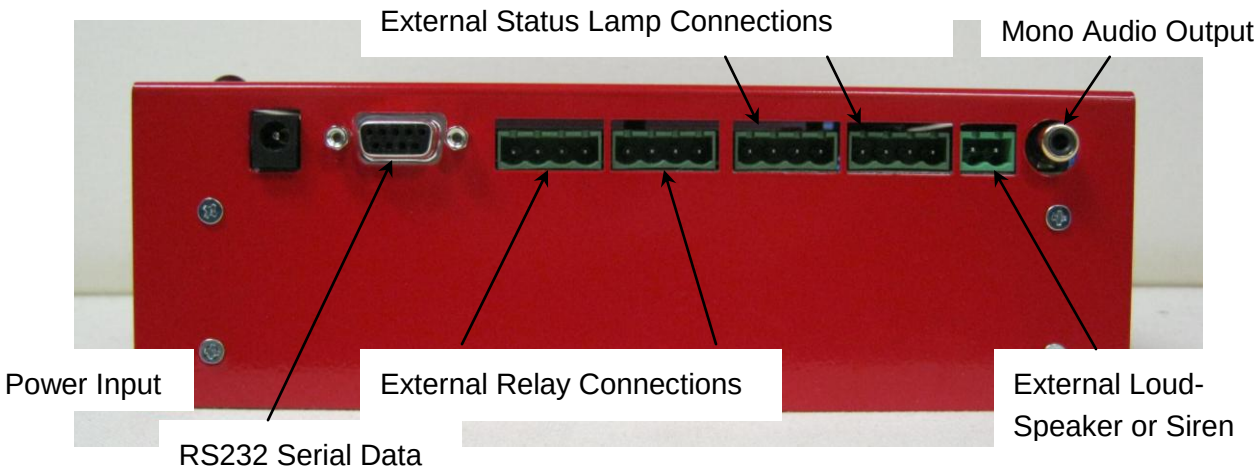
Although the Threat Status LED Lamps are clear when not lit, they do light up in the appropriate FDR colours. The lamps also flash to attract attention. A Catastrophic FDR is signified by the upper two lamps (Amber and Red) flashing alternately.

The loudspeaker will be turned on when the threat level is above Low-Moderate so that any accompanying voice announcements from the FM radio station broadcasting the DAEW signal can be heard.

1.2.6 SAM External Connections

The SAM provides connections for antenna, power, serial data, external siren and display and analog audio output. All connectors are at the base of the unit.

The following picture shows the layout of the connectors:



2 Installation Guide

For the installer familiar with the basic operation of the SAM menu system, the following steps are required to configure the unit for use:

- Remove 8 countersunk M3 screws top and bottom and remove the rear section of the case.
- Connect the battery flying lead to the connector on the back of the PCB paying attention that the correct polarity has been observed.
- Set the volume and tone signalling internal dipswitch options as requested by the user.
- Refit the rear case section and secure it with the screws removed earlier.
- Connect the plug pack to the mains supply, plug the DC lead into the SAM and the antenna lead to the antenna socket. Connect serial, external relay, external lamp and external siren as required.
- Set the cell identification code to the assigned cell number.
- Set the tuner to the frequency of the station broadcasting the DAEW information and store this to preset 1.
- Set FM channel volume to the level requested by the user.
- Verify that the SAM is decoding the DAEW signal and the threat status is flashing green and the LCD is displaying Low-Moderate.

The SAM is now ready for use.

3 Using the SAM

3.1 User Mode

The SAM has no real use for the end user except when an emergency exists. The user can check that the SAM is operational by pressing the control knob in, which will turn on the audio amplifier and send the received audio signal to the internal (and external if fitted) loudspeaker.

Future user-accessible enhancements will include:

- Extensive self-test diagnostic routines that will allow the user to verify that the SAM is operating as it should.
- The ability to monitor any other cell to determine the threat in that cell. The primary use of this function is to evaluate the best escape route in an emergency.

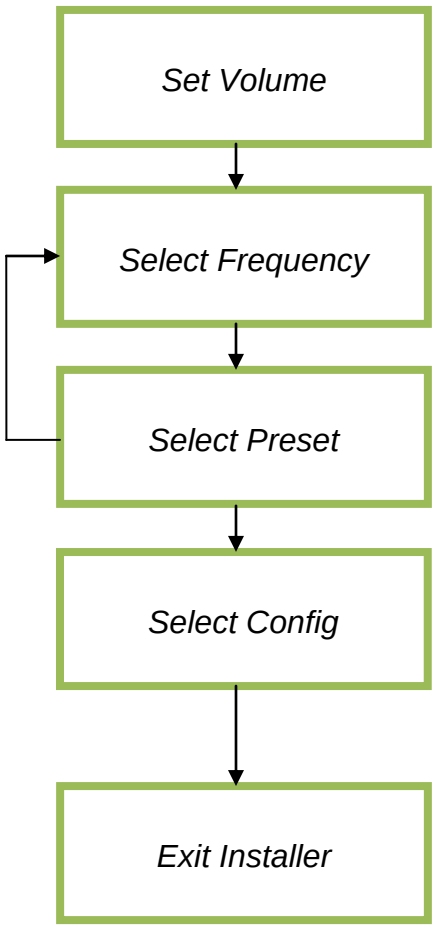
3.2 Installer Mode

Installer mode is accessed from User Mode by pressing the selection knob 4 times within 1 Second. The display will show the message “Exit Installer Y” if this process has been performed correctly.

Rotate the control knob ccw and press it to enter Installer Mode.

In Installer and Configuration Modes, a 30 second inactivity timer is running and will result in operation being returned to User Mode if there is no front panel control actions within this time. Note that the SAM continues to receive and decode any DAEW messages whilst in this mode.

Installer Mode features the following menu structure:



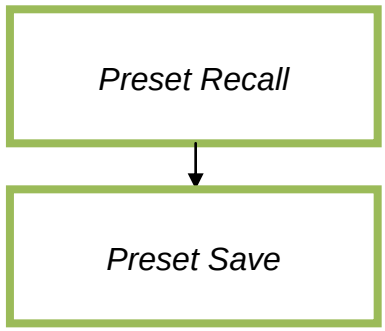
Using the Installer Mode functions as described allows the installer to quickly set up the SAM at the user’s premises; adjust the volume and set up the station presets.

Set Volume is used to adjust the receiver volume to a level suitable for the user. *It should be set so that it demands attention in an emergency situation that may have a high background noise level.*

Select Frequency sets the operating frequency of the radio station carrying the DAEW signal. Rotate the control knob ccw to decrease the frequency or cw to increase the frequency. Press the control knob when the selection is complete. When a selection has been made by pressing the control knob, the next function in the tree (*Select Preset*) is made active.

Note that the frequency step sizes and upper and lower frequency limits for FM are individually configurable as separate items in the Configuration Menu.

Select Preset brings up a sub-menu that allows a preset to either be recalled for editing or to save the current configuration to. The *Select Preset* Menu structure is as follows:



Selecting the *Preset Recall* function allows any of the 20 saved presets for the SAM to be recalled, overwriting the current configuration when the control knob is pressed. Turning the control knob ccw will move the selection down towards preset 1, turning the control knob cw will move the selection up towards preset 20. The *Preset Recall* function may be aborted by rotating the control knob cw from preset 20 to access the exit option.

In a similar fashion, selecting the *Preset Save* function allows the current configuration to be saved to any of the 20 presets when the control knob is pressed. Turning the control knob ccw will move the selection down towards preset 1, turning the control knob cw will move the selection up towards preset 20. The *Preset Save* function may be aborted by rotating the control knob cw from preset 20 to access the exit option.

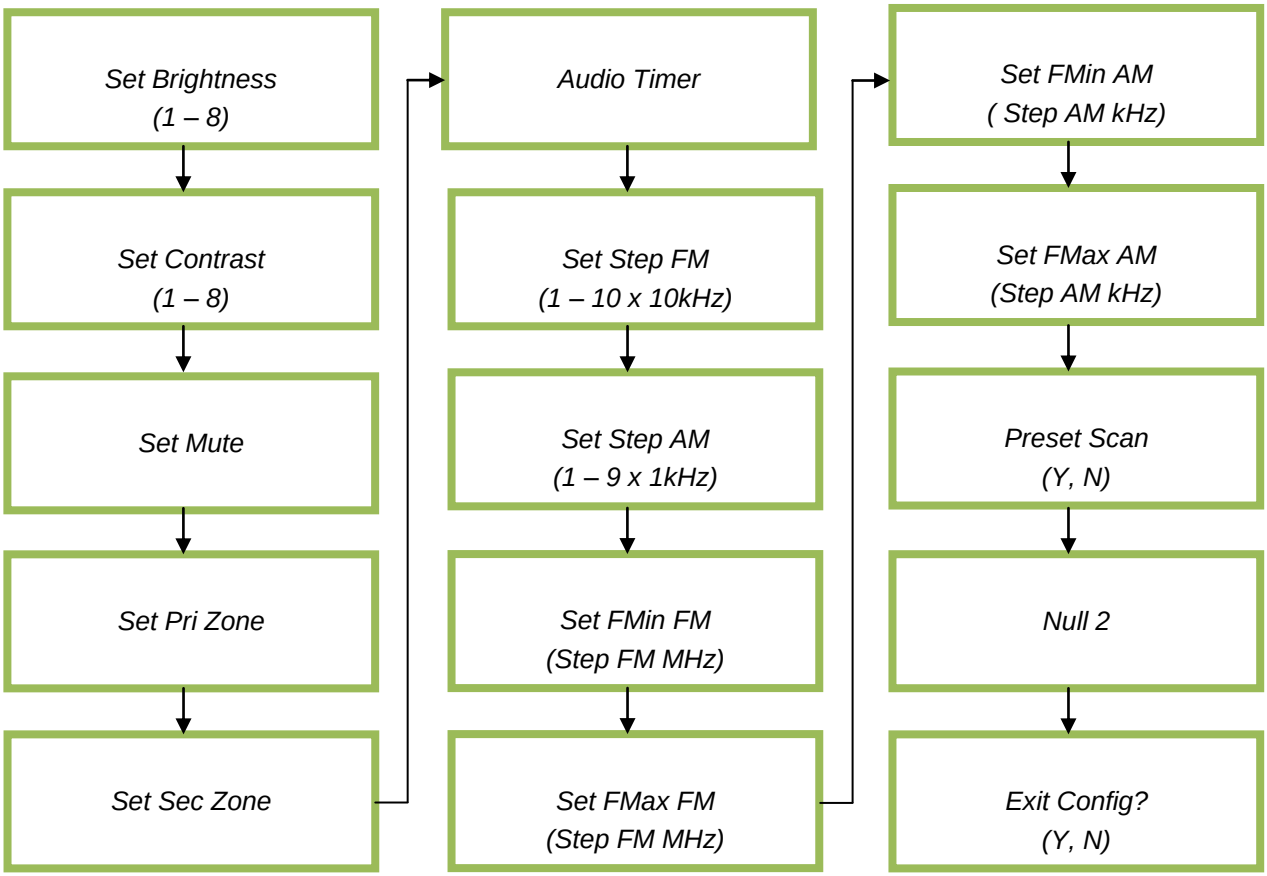
Exiting either of the above functions will result in control being passed back to the *Set Volume* function.

A future enhancement will be to provide a PIN to lock out installer mode to non-qualified access.

3.3 Configuration Mode

The Configuration Mode is used to set up the more basic operational parameters of the receiver. The installer should only ever have to use the configuration functions once, usually at the initial setup stage.

Configuration Mode features the following menu structure:


Set Brightness (1 – 8)
Set Contrast (1 – 8)
Set Mute
Set Pri Zone
Set Sec Zone
Audio Timer
Set Step FM (1 – 10 x 10kHz)
Set Step AM (1 – 9 x 1kHz)
Set FMin FM (Step FM MHz)
Set FMax FM (Step FM MHz)
Set FMin AM (Step AM kHz)
Set FMax AM (Step AM kHz)
Preset Scan (Y, N)
Null 2
Exit Config? (Y, N)

Of the available functions only *Set Brightness*, *Set Contrast* and *Set Pri Zone* should be used. Accessing any of the other functions may cause unpredictable results and possible erroneous operation of the SAM.

Unless otherwise described, exiting one function will result in the next function down the tree being accessed. For example, once the *Set Brightness* function has been used to adjust the display brightness, exiting this function will result in the installer being prompted to access the *Set Contrast* function.

Set Brightness allows the display brightness to be altered to suit the installation. Rotating the control knob ccw to a setting of 1 will result in the backlight being almost off, rotating the control knob cw to a setting of 8 will result in the backlight being driven to maximum brightness. Press the control knob to make the selection and return to the configuration menu.

Set Contrast is used to adjust the contrast of the display characters with respect to the background. This also has an effect on the viewing angle. Rotate the control knob ccw towards setting of 1 or cw towards a setting of 8 to achieve maximum contrast at the normal viewing angle. Press the control knob to make the selection and return to the configuration menu.

Set Pri Zone is used to select the cell code that the SAM is zoned for. At this stage of development the range of cells is 0 through 15. Rotate the control knob ccw towards the minimum setting of 0 or cw towards a maximum setting of 15. Press the control knob to make the selection and return to the configuration menu.

3.4 Storage of Settings

Non-volatile FLASH memory is used to store all operating parameters. This includes all items that are able to be setup in the Installer Menu as well as all items in the Configuration Menu.

It is important to note however, that backup to permanent memory does not happen immediately after each and every change of any parameter, it only takes place after a period of 20 seconds of no activity after a change has taken place. Thus it is important not to power down the unit immediately after making changes to the SAM installer or configuration settings.

3.5 Loss of Signal

Should the SAM not be able to decode a DAEW message with its cell code within a preset time period, it will show “No Cell Message” on the display.

If the SAM experiences loss of valid DAEW signal when not at the Low-moderate level it will presume the worst and autonomously escalate the threat level with successively shorter intervals.

[Ends]

Appendix A: RDS

The SAM decodes the Group 9A codes of RDS Blocks C and D. This is the Emergency Warning System (EWS) allocation of the RDS standard. If you have a receiver capable of displaying RDS messages and it displays text other than the normal data transmitted by the station during the DAEW operation, please advise the station.

Appendix B: External Signals

The SAM makes available some signals for external use. These signals are:

- RS232 raw RDS DAEW data for external processing
- Line level audio for smart home emergency annunciation
- Open-collector drive for an external threat display
- Speaker drive out for an external siren or speaker
- Uncommitted relay contacts for an emergency sprinkler system or other similar device.

The specifications for each of these signals or signal groups is contained in the Specifications Appendix, but it is worth discussing the relay contact function a bit further here.

There are two sets of relay contacts, separately energized. Both sets have the Common, Normally Open and Normally Closed contacts bought out to their respective connectors. Relay A is driven whenever the threat level is above the Low-Moderate level. Relay B is driven whenever the threat level is at the Catastrophic level.

There is no prescribed or recommended implementation for these relays as the variety of end uses is virtually limitless.

A future enhancement will be to provide customizable trigger thresholds for these functions.

Appendix C: Specifications

Parameter	Specification
Control	Bidirectional Rotary Control, Push-to-Select
Text Display	16 characters x 1 line LCD, backlit blue
Text Display Controls	Adjustable Brightness and Contrast
Status Display	6 x high-brightness LEDs
Number of Presets	20
Tuning Range (FM)	Programmable: 88.00 to 108.00 MHz default
Tuning Step Size (FM)	Programmable: 10 to 100kHz
Antenna Input	F-Type Socket
Audio Output	Single (mono) RCA Socket
RS232 Serial Data	DB9 Female, wired DCE
Baud Rate	9600 Baud
Format	8, N, 1
Data format RS232	Binary
Relay Contacts	No/C/NC, 24V DC max, 1Amp max
External Lamp Drive	Open Collector, 12VDC max, 500mA max.
External Speaker Drive	7W, 4Ω minimum
Power Requirements	10 to 35V dc, 1 Amp
Power Connector	2.1mm DC socket, centre positive
Dimensions (W x D x H)	210 x 210 x 70
Weight	2.35kG (without antenna)